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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 198

Contribution from the Office of Experiment Stations
A. C. TRUE, Director

Washington, D. C. PROFESSIONAL PAPER April 21, 1915

REPORT UPON THE CYPRESS CREEK DRAINAGE DISTRICT, DESHA AND CHICOT COUNTIES, ARKANSAS

By

S. H. McCRORY, O. G. BAXTER, D. L. YARNELL, L. A. JONES and W. J. SCHLICK, Drainage Engineers

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INTRODUCTION.

The levees that line the lower Mississippi River ordinarily protect the adjacent alluvial lands from overflow, but this protection is usually only the first step in reclaiming those lands from excessive wetness. The occasional tributaries require that openings be left through the levees or that the streams be diverted long distances from their natural courses. Levees are built along such large tributaries as the Arkansas River, but the junctions of the smaller streams with the Mississippi often permit backwater from the main river to overflow large areas at times of extreme floods.

The southward slope of the general land surface is exceedingly flat, the greatest slope being away from the river to the foot of the hills. The low area is cut with many winding bayous, large and small, each with banks elevated above the adjacent surface approximately in proportion to the depth of the channel. These high banks, so characteristic of alluvial lands, pond the water upon the area and

NOTE.—This bulletin will be of interest to landowners, engineers, and others interested in the reclamation of swamp and overflowed lands along the Mississippi River below the mouth of the Missouri River.

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prevent drainage. The conditions in the Cypress Creek drainage district of Desha and Chicot Counties, Arkansas, are typical.

It has long been apparent that an interior drainage system is needed to supplement the sixty-odd miles of levee built to protect this district from the floods of the Mississippi and Arkansas Rivers. In 1906, John T. Stewart, drainage engineer of the Office of Experiment Stations of the United States Department of Agriculture, made a survey for the relief of the wet land in the neighborhood of Arkansas City, that project being known as Desha County Drainage District No. 1. The improvements constructed in that district were, however, of only local benefit. The first active step in the direction of a comprehensive drainage system for the county was taken in 1907, when engineers of the Mississippi River Commission made a survey which had among its objects the location of a feasible line for the diversion of Cypress Creek. The report on that survey stated that the project was entirely feasible, but recommended that further surveys be made before construction was undertaken, in order that other routes might be compared with the one laid out.

No further action was taken until early in 1911, when further assistance was requested from Drainage Investigations, Office of Experiment Stations, United States Department of Agriculture. An agreement was ultimately reached whereby Drainage Investigations undertook to make the survey, one-half the cost to be paid by the Cypress Creek drainage district, which had in the meantime been created by the Arkansas Legislature.[1] The survey was begun in September, 1911, and completed in March of the following year.

GENERAL DESCRIPTION.

LOCATION AND AREA.

The Cypress Creek drainage district borders the Mississippi River in southeastern Arkansas (see fig. 1), including about 65 per cent of the total area of Desha County and extending 2 miles into Chicot County, which is in the southeast corner of the State. Memphis is about 110 miles northeast and Little Rock about 85 miles northwest of the center of Desha County. Arkansas City, the county seat, and McGehee are the most important towns in the district; Pine Bluff, on the Arkansas River about midway between Desha County and Little Rock, and Helena, 60 miles north on the Mississippi River, are cities of local prominence.

As defined by the legislative act, the district is roughly triangular in shape, with an apex to the south. Its greatest width east and west is about 23 miles, near the north end, and its extreme length north and south is approximately 36 miles. The total area is 466 square miles.

[1] Thirty-eighth General Assembly of Arkansas, Acts 110 and 445.

TOPOGRAPHY.

The land may be classified as Mississippi bottom land, nearly the whole district being below the higher flood stages of the river or of the bayous when their waters are held back by the river floods. The highest land lies in the northwest corner, the extreme elevation being in the neighborhood of 170 feet above sea level. In the southern part of the district elevations as low as 128 are found. In the northern part the fall to the south is quite well defined, as is also the fall to the east in the western part. The land bordering the Mississippi River, however, slopes away from that stream. Below Cypress

FIG. 1.—Map of Arkansas, showing location of Cypress Creek drainage district.

Creek, in the central part of the district, the slope of the land to the south is much less. Stretches of land are found here with a practically uniform elevation for several miles, broken only by the elevated banks of intervening bayous that act as barriers to the flow of drainage water southward. These conditions result in vast accumulations of water that in even ordinarily wet seasons cover these flats, making the country impassable for long periods.

The general trend of the streams for a considerable distance after they enter the district from the west is to the southeast. As they

encounter the belt of elevated land bordering the river, however, they are diverted directly south, their waters eventually reaching Bayou Macon. An exception to this condition is Cypress Creek. As may be seen by figure 1, this stream maintains an outlet directly into the river at about the center of the eastern boundary of the district. It is owing to this fact that a continuous levee can not be constructed along the front of the district under present conditions to exclude the damaging river floods.

AGRICULTURAL CONDITIONS.

The cultivated areas are mostly confined to the high lands along the bayous, and at present comprise probably not more than 10 per cent of the district; all of these will be benefited by the proposed ditches, which will afford outlets for underdrainage. The top soil generally is the ordinary Mississippi alluvium, modified more or less by decayed vegetation. Cotton forms the main crop, though some rice is grown in the north part of the district along the Arkansas River. While by far the larger part of the district is wooded, the area has been fairly well cut over and the larger timber removed. Some logging is still done, but the cutting of railroad ties and stave bolts forms a considerable part of the timber industry. Fairly good roads are maintained along the high-banked bayous, but travel over the roads of the low lands of the interior is rendered uncertain by overflow. Land values depend largely upon accessibility and degree of drainage.

PRESENT DRAINAGE CONDITIONS.

MISSISSIPPI RIVER FLOODS.

Primarily, the reclamation of the area covered by the Cypress Creek drainage district is dependent upon the exclusion of the flood water of the bordering rivers. Before the levees were constructed along the Mississippi and Arkansas Rivers, the larger part of the area now included within the boundaries of the district had been subject to intermittent overflow from these streams. The period during which some measure of protection has been had from levees extends back a great many years. During all this time the levees have from time to time been increased in cross section, as higher flood stages demanded and as funds permitted, until now, so far as they have been constructed at all, the levees are expected to afford protection against any flood that may be looked for in the light of past experience. The flood of 1912, during which the river rose at Arkansas City to a stage of 2.5 feet higher than any previous record, required the temporary raising of the levee, but did not cause any crevasses along the Desha County front. Apparently the only serious defect in the levee system is the gap at the mouth of Cypress Creek. By reference to figure 2 it will be seen that in the southwest corner of T. 10 S., R.

1 W., there is a gap of about 2 miles between the southern end of the Arkansas River levee and the northern end of the Mississippi River levee. It is, of course, impracticable to close this opening without first diverting Cypress Creek. The existence of this gap partially nullifies the benefits from these levees so far as this district and a considerable area to the south are concerned. Figure 2 (in pocket at end of bulletin) shows the area in Desha County that was submerged by the Mississippi River flood of 1912, due to the inflow of water through this opening. This amounts to about 202,000 acres, or approximately two-thirds of the total area of the district. No crevasses occurred in the levees bounding the district during this flood, and but for the existence of the levee gap there probably would have been no damage from the river itself.

DRAINAGE OUTLETS.

The small degree of interior drainage now existing is secured through the numerous bayous and creeks which meander through the district (see figs. 3 and 4, in pocket at end of bulletin). The drainage from that portion north of Amos Bayou is discharged into the Mississippi River through Cypress Creek, being collected by a number of tortuous and ill-defined tributaries distributed generally over the area. The drainage tributary to Amos Bayou, as well as that from the entire area of the district south of this bayou, is discharged into Macon Lake, whose northern end is located about 3 miles south of the Desha-Chicot County line.

The bayous are of the usual type encountered in the Delta section, being tortuous, frequently ill defined, and of irregular width. They often widen out into lakelike bodies of practically dead water and again contract into narrow channels. They are usually encumbered with drift and débris of all sorts, and particularly in their wider portions often contain growths of standing timber and various forms of water-loving vegetation. As these bayous approach the Mississippi River they usually undergo a marked contraction in cross section. This peculiarity is probably due to the backing up of river water in these bayous before the levees were constructed, the resulting obstruction to the current causing the deposition of suspended matter brought down from above. The land immediately adjoining the bayous is usually higher than that a short distance back from the streams. This condition, characteristic of Mississippi Delta bayous, as of the river itself, is especially marked along Amos and Macon Bayous, whose banks are frequently as much as 6 to 10 feet above the general elevation of the surrounding area.

The existing outlets are not sufficient to care for the run-off tributary to them. A moderate winter rain, even when the Mississippi is at normal stage, causes the flooding of large areas. The high banks of the bayous prevent a quick return of this water to the channels, and thus the lowlands remain covered with water for long

periods after the streams themselves have returned to a normal stage. A similar condition occurs when the land is flooded by backwater coming through the levee gap from the river. The land being lower than the banks of the streams, a large area is left covered with water, which disappears very slowly.

THE SURVEY.

Base level lines were run along the railroads and cross-level lines were run on all east and west section lines. All bayous and water courses were meandered and channel sections were taken where needed; in many cases levels were carried with the meanders. A base level line was carried through Lincoln County on the main line of the St. Louis, Iron Mountain & Southern Railway, and some cross-level lines were run in this county as aids in the determination of the topography of the watershed. A reconnaissance of Lincoln County was also made. The levels were tied to precise level bench marks at Arkansas City, Trippe Junction, Walnut Lake, and Varner.[1]

Bench marks [2] were set approximately one-half mile apart on the level lines. Usually these were root bench marks, the trunk of the tree being blazed and the number of the bench mark inscribed. These were set as near as practicable to section and quarter section corners.

Soil borings were taken on the main ditch lines, and these borings, showing the character of soil encountered, are indicated on the profiles (fig. 6, in pocket at end of bulletin).

Gauging stations were established at various points over the district, and daily records kept of the gauge readings. The highest water-surface elevations observed are shown in figure 2. Current meter measurements were begun in March, 1912, during the heavy rains, but it was impossible to continue them, owing to the backwater from the Mississippi River, which flowed through the gap in the levee. The boundary of the flooded area (fig. 2), due to inflow through this gap, was obtained by personal observations and was checked by the gauge heights as furnished by the gauge readers.

THE DRAINAGE PROBLEM.

The water from which the district must be protected comes from two sources; first, direct precipitation upon the watershed in which the district lies, and second, overflow from the Mississippi River,

[1] The descriptions and elevations of these bench marks were obtained from U. S. Geological Survey Professional Paper No. 46 (1906). That publication states that the elevations of these bench marks are referred to mean Gulf datum, but since the conclusion of the survey it has been found that these elevations had been corrected by a small constant. The results obtained from ties made to the Mississippi River Commission bench marks show that 7.35 feet should be subtracted from Memphis datum elevations in order to reduce them to the datum used in this survey.

[2] A list of the bench marks set, with their elevations, locations, and descriptions, is on file with Drainage Investigations, United States Department of Agriculture.

whose backwater enters the district through the gap in the levees at the mouth of Cypress Creek, damaging not only the district itself, but a large area in Chicot County, Arkansas, and northern Louisiana, since such water, once behind the Mississippi River levee, must flow south to the Red River. The drainage problem, then, is not only to provide the necessary outlets and laterals to care for the run-off from the 658 square miles tributary to the district, but to so design and locate these outlets that the drainage water now entering the Mississippi River through the levee gap will be diverted, thus making it possible to close this gap. With the construction of these outlets and the closing of the levee gap the reclamation of the district will be assured.

RUN-OFF.

No phase of the preliminary study of a drainage project has a more vital bearing upon the success of the undertaking than the determination of the rate of run-off for which provision must be made. Obviously, precipitation is the most important element to be considered in the study of run-off, although certain other factors have more or less effect upon the rate of run-off. These are the size, shape, and topography of the watershed; the character of soil and vegetation; the rate of evaporation; the climate and seasons; and the water storage capacity of the soil, stream channels, and other natural reservoirs.

RUN-OFF INVESTIGATIONS MADE.

RAINFALL.

Southeast Arkansas is characterized by high humidity and heavy rainfall. The rainfall records of the United States Weather Bureau for Arkansas City and Pine Bluff have been carefully examined, the former station being the only one in the Cypress Creek drainage district. The records for Pine Bluff, however, may be taken as indicating rainfall conditions on the upper portion of the Cypress Creek watershed.

The average annual rainfall for Arkansas City, including the year 1912, is 45.23 inches, and for Pine Bluff, 49.63 inches. The records for Arkansas City for the years 1897 to 1911, inclusive (not including the years 1907 and 1908, for which records are incomplete), show the greatest annual rainfall to have been 70 inches, in 1911, and the minimum to have been 26.83 inches, in 1901. At Pine Bluff the maximum annual rainfall for the same period was 82.89 inches, in 1905, and the minimum 37.21 inches, in 1901. The greatest monthly rainfall recorded at Arkansas City was 15.42 inches in December, 1911, and at Pine Bluff, 15.71 inches in May, 1905.

Some of the heaviest storm periods at Arkansas City during the 16 years preceding 1913 were as follows: December 7–16, 1911, 9.7 inches;

August 13–16, 1911, 7.9 inches; February 9–15, 1908, 9.7 inches; and July 27–August 2, 1902, 9.2 inches. The heaviest 48-hour rainfalls were: August 13–14, 1911, 7.1 inches; February 13–14, 1908, 6.8 inches; and July 30–31, 1902, 7.8 inches. The greatest 24-hour rainfall recorded at Arkansas City occurred on April 4, 1911, when 5.6 inches fell. Other heavy 24-hour storms were 5.5 inches on July 17, 1906; 5.5 inches on August 13, 1911; and 5.1 inches on December 27, 1904. From January, 1897, to December, 1912, there are recorded 13 days when 3 inches or more fell in 24 hours, and 63 days when 2 inches or more fell in a like period. The most intense rainfall on record at Arkansas City occurred on July 17, 1906, when 4.8 inches fell in 2 hours.

Among the heaviest storm periods at Pine Bluff were: November 16–21, 1906, 10.3 inches; May 4–6, 1905, 9.4 inches; and January 1–3, 1897, 9 inches. The heaviest 48-hour rainfalls were: November 16–17, 1906, 6.6 inches; May 4–5, 1905, 8.8 inches; and July 31–August 1, 1902, 6.9 inches. The heaviest 24-hour rainfalls on record at Pine Bluff are: 5.65 inches on January 21, 1906; 6.8 inches on May 4, 1905, and 5.58 inches on January 3, 1897. Other unusually heavy 24-hour storms recorded are 4.7 inches on November 19, 1907, and 4.7 inches on July 31, 1902. During the 16 years from 1897 to 1912 there were 32 days when 3 inches or more fell in 24 hours, and 84 days when a rainfall of 2 inches or more was recorded.

STREAM GAUGING AND OTHER INVESTIGATIONS.

During the spring of 1911 run-off investigations were made on Boggy Bayou, the outlet for Desha County district No. 1. The area of this district is 165 square miles above the point where the discharge measurements were made. On April 4, 1911, occurred the heaviest 24-hour precipitation on record. This caused a measured discharge of 1,815 second-feet, or a run-off of 11 second-feet per square mile from the district. In March and April, 1912, very high stages occurred in Boggy Bayou. During the latter part of March and April, the Mississippi River rose very rapidly, and probably about March 27–29 the water began to flow from Cypress Creek and Wells Bayou to Boggy Bayou through Johnson Brake, Newman Slough, and Amos Bayou. The water begins to take this course when the Mississippi River backwater reaches an elevation of approximately 149 in Cypress Creek. It is probable that under present conditions the maximum discharge from Boggy Bayou due to precipitation alone seldom, if ever, exceeds that of April 4, 1911.

Stream measurements were made on Cypress Creek at the Memphis, Helena & Louisiana Railroad bridge south of Watson in March, 1912, until the backwater from the Mississippi River became too high. These measurements show that just before the river water

began to back up the creek on March 28 the discharge was 2,730 second-feet from a drainage area of 390 square miles, or 7 second-feet per square mile. Considering the heavy rains that followed, it is safe to say that a much greater discharge would have been obtained if a measurement could have been taken on April 4.

A current-meter measurement was made of Black Pond Slough at the railroad bridge west of Halley on the evening of April 4, 1911. This measurement gave a discharge of 449 second-feet from a drainage area of 23.5 square miles, or the rate of run-off was 19.1 cubic feet per second per square mile.

In planning the improvements of the Bogue Phalia, in Bolivar County, Miss., the 24-hour run-off was one-half inch from a drainage area of 350 square miles. The results so far observed seem to justify the use of this coefficient. The conditions in the Bolivar County district are very similar to those in the Cypress Creek district.

Other run-off data for the Mississippi Valley have been examined, including those obtained in Coahoma County, Miss., by C. W. Okey, and much that have been compiled by the Tallahatchie drainage district, Mississippi.

DETERMINATION OF RUN-OFF COEFFICIENTS.

Experience has shown that draining and clearing timbered land results in an increased rate of run-off, and so far as the district in question is concerned, there is ample reason to believe that such will be the case. The water that under present conditions can reach the main outlets only by circuitous routes will, after the drainage system is installed, have direct access to the drainage outlets through the numerous submains and laterals penetrating the interior. Such storage capacity as now exists will be greatly reduced. The substitution of deep, well-aligned ditches for the existing tortuous, débris-filled natural channels will facilitate the movement of the water from the entire drained area; in other words, will cause a quicker and more intense run-off than obtains under present conditions. In view of the effects that draining the land will have, it would be unsafe to base the selection of the run-off coefficients entirely upon the results of any gaugings made under present conditions, although these are useful in serving as checks upon such conclusions as may be reached.

In deciding upon the run-off coefficients to be used for the Cypress Creek drainage district the following method was pursued: A trial coefficient was selected for a small area, one for a medium area, and one for a large area, and an algebraic expression was then sought whose curve would approximately fit these platted coefficients. The run-offs for intermediate areas were then calculated and plotted and the curve thus obtained was compared with all the data derived

from the gaugings. The formula was changed and the investigations continued until a satisfactory curve was obtained.

After an examination of the results of the gaugings heretofore described, taking into consideration the probable effect that the reclamation of the district will have on the rate of run-off, and after a study of some of the larger drainage districts in the immediate vicinity of the Cypress Creek drainage district, the following tentative assumptions were made as to run-off:

From 5 square miles, 1 inch in 24 hours (26.88 second-feet per square mile); from 25 square miles, $\frac{3}{4}$ inch in 24 hours (20.20 second-feet per square mile); from 400 square miles, $\frac{1}{2}$ inch in 24 hours (13.44 second-feet per square mile).

It was found that Fanning's formula could be converted into an expression whose curve fulfilled these assumptions. The conversion of this formula is as follows:

Fanning's formula is: $Q = 200\ M^{\frac{5}{6}}$

Where Q = run-off from whole area, in second-feet,
and M = area of watershed, in square miles.

Substituting K for 200, and RM for Q (where R = the run-off in second-feet per square mile), we have:

$$RM = KM^{\frac{5}{6}} \text{ or } R = \frac{KM^{\frac{5}{6}}}{M} = \frac{K}{\sqrt[6]{M}} \qquad (1)$$

whence $K = R\sqrt[6]{M}$

Substituting the three assumed values of R and M, we have:

For $R = 26.88$, $K = 35$
For $R = 20.2$, $K = 34.5$
For $R = 13.44$, $K = 36.4$

Replacing the constant, K, by 35 in formula (1), we have:

$$R = \frac{35}{\sqrt[6]{M}}$$

This expression, which has been used for calculating run-off in this project, is represented by the curve in figure 5. It was found to agree fairly closely with what gaugings have been made, giving in most cases values somewhat greater than the gaugings showed. As has been pointed out, however, overflow and backwater affected some of the gaugings and tended to give discharges less than the actual ones. Allowance has also been made for increased run-off to be expected after drainage.

DRAINAGE PLANS CONSIDERED.

Before the final plan, as hereafter stated, was decided upon, other possible methods were carefully worked out and compared.

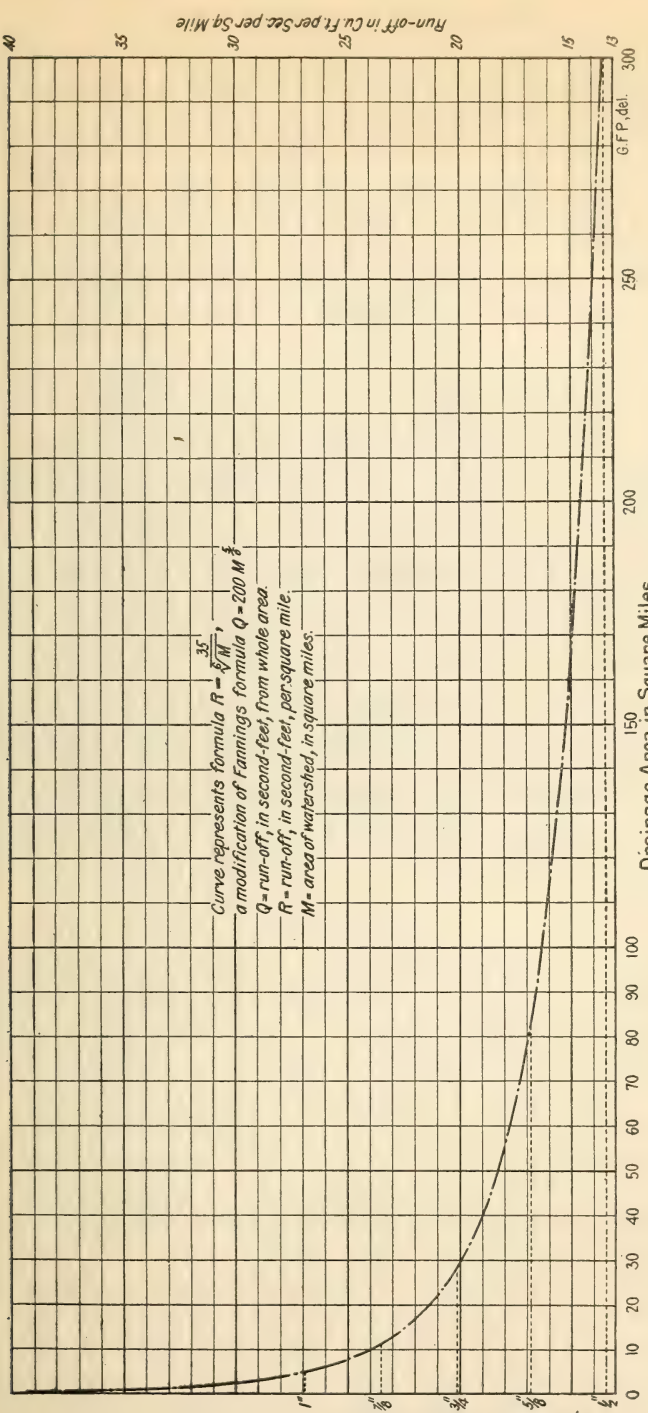

FIG. 5.—Curve showing run-off to be provided for by proposed drainage ditches.

MISSISSIPPI RIVER COMMISSION PLAN.

The plan of the Mississippi River Commission, made in 1907, provides merely for the diversion of Cypress Creek in order that the gap in the levee may be closed, and makes no provision for the further drainage of Desha County. The suggested course of the diversion is through Boggy Bayou, Boggy Lake, Clay Bayou, and Clay Bayou Wash into Macon Lake in Chicot County. The plan provides for 2,300 second-feet of flow at Boggy Cut-off and 3,150 second-feet above Macon Lake, requiring a channel of 60 to 80 feet in bottom width, with side slopes 1½ horizontal to 1 vertical, flowing 11 to 11½ feet deep.

The area drained by Cypress Creek is approximately 413 square miles, and that by Clay Bayou about 582 square miles. Using the drainage coefficients determined from figure 5, the capacity of the diversion channel should be 5,300 second-feet at Boggy Cut-off and 7,050 second-feet at Macon Lake. In order to obtain a proper fall in the ditch and to give drainage to the upper district, it would be necessary to hold the high-water surface in this diversion channel 3 to 4 feet below ground level. Since 15 to 16 feet is about the deepest economical excavation, the depth of flow should be about 12 feet. The required channel would then be 140 to 185 feet, 15 to 16 feet deep, with 1 to 1 side slopes. There are two reasons for rejecting this plan in favor of the ditch plan recommended: First, the cross section of the necessary channel is too great for the most economical construction; second, it will not serve effectively as the main drainage outlet for the district, principally because of the high banks along the larger tributaries. It has no advantage over the plan herein recommended.

FLOODWAY PLAN.

A system involving a combination of ditches and floodway was worked out in detail. This plan provides for carrying the drainage from Wells Bayou, Cypress Creek, and Oak Log Bayou through a floodway from Amos Bayou, in sec. 30, T. 10 S., R. 2 W., to Bayou Macon near McArthur. From here the channel of Bayou Macon was to be cleared as in the recommended plan. The drainage from a small area at the head of the Coon Bayou watershed would, under this plan, be diverted into the head of Bayou Macon. The remainder of the Coon Bayou drainage was to be carried under the floodway to the ditches in the eastern part of the district.

The floodway would be a canal 90 to 200 feet in bottom width, excavated 5.5 to 23.7 feet deep, with levees on each side 4.5 to 13 feet high, except at the banks of Amos Bayou and Bayou Macon, where no levees would be required. The total earthwork for this floodway was computed to be 2,186,000 cubic yards, which is estimated would

cost 15 cents per yard owing to the unusual depth of cut and to the added work of placing the spoil in good levees. The total cost of the floodway and the auxiliary ditch system necessary was estimated approximately equal to the cost of the ditch plan presented in the following pages.

The floodway plan is not recommended because the unusual difficulties of construction have rendered the estimate of cost less certain than that for the ditch plan, because the attitude of the landowners in general is opposed to a channel between levees, but principally because of the greater danger if maintenance work is neglected. Very few drainage ditches are regularly inspected and kept in even fair condition, usually being entirely neglected until serious overflows occur. An ordinary ditch is injured little when its capacity is overtaxed, and aids in removing the water quickly both during and after the overflow period. If this floodway were constructed, however, and by reason of improper maintenance or unprecedented flood flow it should be overtaxed, not only would great expense be necessary to repair the damage to the levees, but the embankments remaining in position would tend to prevent the water from returning into the channel.

DITCH PLAN.

This plan includes the clearing of Bayou Macon and Boggy Bayou, but otherwise generally disregards the natural watercourses for main drainage channels. It is presented as being the plan that will give the best drainage results with the minimum difficulties of construction and cost of maintenance, and is discussed in detail below.

THE RECOMMENDED PLAN.

DRAINAGE DISTRICT BOUNDARIES.

Cypress Creek drainage district, according to the boundaries defined in act 110 of the Thirty-eighth General Assembly of Arkansas, contains 298,450 acres, or 466 square miles. The total drainage area tributary to the district is 658 square miles, of which 188 square miles are in Lincoln and Jefferson Counties (see fig. 4) and 13 square miles in Drew County. The drainage district should include only such land as would be benefited by the improvements. On this basis the following described boundaries are proposed, as a result of the survey:

The district should include all of Desha County lying south and west of the Arkansas and Mississippi River levees, as now constructed and surveyed, except that part lying west of the following described line: Beginning 2,000 feet north of the southwest corner of sec. 7, T. 9 S., R. 4 W., and running east to the left bank of Choctaw Bayou; thence following the left bank of Choctaw Bayou to Walnut Lake; thence following the left bank of Walnut Lake to the north and south

quarter line of the NW. ¼ sec. 9, T. 10 S., R. 4 W.; thence in a general southerly direction, following the west watershed boundary of the district as shown on the map (fig. 3). The district should also include the following land in Chicot County: All that portion of T. 13 S., R. 1 W., lying west of the Mississippi River levee; all that portion of secs. 6 and 7, T. 14 S., R. 1 W., lying west of the Mississippi River levee; all of secs. 1, 2, 3, 4, 10, 11, and 12, and those portions of secs. 5, 8, and 9, T. 14 S., R. 2 W., lying east of the west watershed boundary of the district. That part of Drew County, containing 8,474 acres, lying east of the district watershed boundary should also be included in the drainage district. With these boundaries, the district would contain 294,784 acres, or 460.6 square miles.

THE DITCH SYSTEM.

In planning this system it was of course necessary to keep the sizes of all outlets within the limits of practical construction. For this reason certain diversions were necessary (see fig. 3).

Wells Bayou, now emptying into Cypress Creek, is diverted in sec. 9, T. 10 S., R. 4 W., by ditch No. 13, flowing into Bayou Macon in sec. 3, T. 12 S., R. 3 W. It is not feasible to divert the water from Wells Bayou into Bayou Bartholomew on account of the high stages that occur in the latter stream, which probably would be considerably increased if Wells Bayou were discharged into it. There is an impression among the local residents that at times Bayou Bartholomew discharges considerable water into Wells Bayou through Cross Bayou in T. 9 S., R. 6 W. An examination made at this point on April 3, 1912, on which date occurred the highest stage ever recorded in Bayou Bartholomew, showed only a very small amount of water entering Wells Bayou from this source.

The diversion of Cypress Creek is accomplished as follows: First, all that portion above the south line of sec. 13, T. 9 S., R. 4 W., is diverted at this point by ditch No. 19, flowing directly to Bayou Macon in sec. 18, T. 11 S., R. 3 W. The latter stream is to be improved from this point to Macon Lake. Second, ditch No. 43 crosses Cypress Creek in sec. 1, T. 10 S., R. 3 W., which will take the drainage from Oak Log Bayou, now tributary to Cypress Creek, directly south to Macon Lake. Third, by a combination of channel improvement and ditch No. 81 the drainage tributary to the lower end of Cypress Creek is carried to Macon Lake through Boggy Bayou, Boggy Lake, Clay Bayou, and Clay Bayou Wash.

The diversion of the greater part of Cypress Creek into Bayou Macon, as noted above, will so raise the level of this stream in the vicinity of the present mouth of Little Bayou Macon that other provision will have to be made for the latter outlet. The drainage tributary to Little Bayou Macon is therefore carried south by ditch No. 18

into Lost Chain Creek and thence into Bayou Macon in sec. 32, T. 13 S., R. 2 W.

Although natural channels have been utilized wherever possible, it was frequently found advisable to locate the ditches entirely independent of existing streams, on account of the high banks, poor alignment, and cost of clearing of the latter.

Laterals are provided in sufficient number and of such depth as to afford good drainage to the areas lying back from the mains when the necessary field ditches are constructed.

DETAILS OF DITCHES.

All of the proposed work is shown in figure 3. Profiles of ditches Nos. 13, 18, 19, 43, 66, 67, 76, and 81 are shown in figure 6 (in pocket at end of bulletin). Tables of hydraulic and construction data for each ditch are on file with Drainage Investigations, United States Department of Agriculture.

Kutter's formula has been used in all cases in computing the capacities of the ditches. A roughness coefficient of 0.025 has been used for all artificial channels and of 0.035 for existing channels that are to be cleared. In ditch No. 19, from station 949 to station 976, where the channel of Coon Bayou is to be cleared and grubbed, a coefficient of 0.030 was used. Where practicable, the proposed high-water lines in the channels are placed 1 to 2 feet below the surface of the ground. The grades are made as uniform as practicable, and at points where the grade is decreased, thereby necessitating larger ditch sections, the depth of flow is increased rather than the bottom width, in order to avoid great changes in velocity.

The minimum ditch planned has a bottom width of 14 feet, side slopes ½ to 1, and depth of flow 6 feet. This is the smallest that can be constructed economically by a floating dredge in timbered lands. The width of berm is independent of the width of the ditch, but varies with the depth of excavation. For cuts of 10 feet or less a berm of 10 feet is planned; for cuts of 10 to 15 feet a berm of 12 feet; and for cuts deeper than 15 feet a berm of 15 feet is proposed.

In existing channels where clearing is the only improvement needed all timber and underbrush should be cut and all débris removed. No stumps should project more than 18 inches above the ground. A short section of ditch No. 19, in Coon Bayou, will need to be cleared and grubbed in order that it may have the required capacity; in this section all stumps should be removed or cut level with the ground in addition to the ordinary clearing.

The widths required as right of way for the ditches were computed by taking three and one-half times the top width of the ditch plus the width of both berms. The cost of right of way was estimated at $20 per acre. No allowance was made for this cost where the ditches follow present channels.

All improvements were planned from the data collected by the preliminary survey, as the ditches have not been located in the field. The location survey may show that some slight changes would be advisable, but such changes will not materially affect the amount of excavation. The lateral ditches in most cases follow section lines to avoid cutting up the land into irregular tracts, but it was necessary to locate some of them without regard to land lines. The main ditches are briefly discussed in following paragraphs:

Ditch No. 13.—It is proposed to construct an earth dam, at an estimated cost of $5,000, across Walnut Lake near the center of sec. 11, T. 10 S., R. 4 W., and to divert the water from the Wells Bayou watershed to Bayou Macon through ditch No. 13. The probable high water in Walnut Lake will be 155.7, which is approximately the same as that under existing conditions. The low-water elevation will not be changed to any appreciable extent. A small earth dam is to be constructed across Caney Bayou in sec. 33, T. 10 S., R. 4 W., at an estimated cost of $300, to prevent overflow into the district from Eastham Brake. The side slopes of ditch No. 13 are planned to be 1 to 1 except from station 450 (in sec. 12, T. 11 S., R. 4 W.) to station 781 (the end), where side slopes of 2 to 1 are necessary on account of the sandy soil that will be encountered.

Ditch No. 19.—A solid waste bank, to prevent overflow, is necessary at the following points along ditch No. 19: On the east side where the ditch crosses Wells Bayou in sec. 7, T. 10 S., R. 3 W.; on the west side at both crossings of Dry Bayou in sec. 31, T. 10 S., R. 3 W.; and on the west side at Coon Bayou in sec. 6, T. 11 S., R. 3 W. An earth dam, estimated to cost $1,000, is planned to be constructed across Coon Bayou in the northeast part of sec. 18, T. 11 S., R. 3 W., to prevent high water in ditch No. 19 from flowing to the east. This dam should be constructed with a small sluice gate in order that Coon Bayou may be drained during low water. On account of the sandy soil the side slopes are made 2 to 1 from station 765 (in sec. 19, T. 10 S., R. 3 W.) to station 895 (in sec. 6, T. 11 S., R. 3 W.), and from station 1003 to station 1014 (in sec. 18, T. 11 S., R. 3 W.). The section from station 765 to station 895, where the average depth of cut is about 14 feet and the maximum cut is 21.5 feet (on the bank of Amos Bayou), is estimated at 9 cents per cubic yard. All other excavation on this ditch is estimated at 8 cents. From station 949 to station 1003 (in sec. 7, T. 11 S., R. 3 W.) the ditch follows the channel of Coon Bayou and no excavation is required. The section from station 949 to station 976 must be cleared and grubbed. This work is estimated at $3,000 per mile. From station 976 to station 1003 the only improvement needed is clearing at an estimated cost of $2,000 per mile.

The excavation work in ditch No. 19 ends in Bayou Macon on the south line of sec. 28, T. 11 S., R. 3 W. From this point to Macon

Lake the channel must be cleared, at an estimated cost of $2,000 per mile. In addition, the openings in the banks of Bayou Macon must be closed, especially the channel of Little Bayou Macon. The estimate for this work, based on meager data, is 35,000 cubic yards at 20 cents per yard, or a total expense of $7,000.

Ditch No. 43.—The soil borings along the proposed route of ditch No. 43 show considerable sand from a point near Wells Bayou to Gum Pond, south of Amos Bayou. The depth of flow through this section is therefore made 8 feet and the side slopes 2 to 1. The difference in elevations of the Wells Bayou basin and the Coon Bayou basin is 10 feet in a distance of 5½ miles. It was impossible to utilize all of this fall on account of the depth of cut that would be encountered in crossing the banks of Amos Bayou and also on account of the erosion that would occur from high velocities in sandy soil. A 6-foot concrete drop is therefore planned at station 750 (in sec. 36, T. 10 S., R. 3 W.) at an estimated cost of $5,600. An earth dam, estimated cost $1,000, is planned in Cypress Creek to prevent the water in ditch No. 43 from flowing to the east. At the crossing of Coon Bayou, in the west line of sec. 19, T. 11 S., R. 2 W., a solid waste bank should be made on the east to prevent overflow into Coon Bayou. In addition to the small amount of excavation in Cypress Creek, station 430 to station 458 (in sec. 36, T. 9 S., R. 3 W.), clearing of channel is estimated at $1,000 per mile.

All excavation in this ditch is estimated at 8 cents per yard except that section from station 600 (at lateral No. 34) to station 700 (in sec. 25, T. 10 S., R. 3 W.), which is estimated at 9 cents. The maximum cut in this section is 20.1 feet, on the bank of Amos Bayou, and the side slopes are 2 to 1.

Ditch No. 81.—The following reaches of ditch No. 81 will require no excavation, but the existing channel must be cleared: From station 155 to station 198 (in sec. 33, T. 9 S., R. 2 W., and sec. 4, T. 10 S., R. 2 W.), and from station 447 to station 760 (in secs. 8–31, T. 10 S., R. 1 W.) in Cypress Creek; from station 781 to station 953 (in secs. 1–14, T. 11 S., R. 2 W.) in Boggy Cut-off and Boggy Bayou; from station 1080 to station 1151+75 (in sec. 26, T. 11 S., R. 2 W.) in Isaacs Lake; and from station 1368+50 (in sec. 14, T. 12 S., R. 2 W.) to station 1700 (in sec. 12, T. 13 S., R. 2 W.) in Boggy Lake. All clearing of channel is estimated at $1,000 per mile except in Boggy Lake, where it will be light, and is estimated at $500 per mile. All side slopes are estimated 1 to 1, and all excavation is estimated at 8 cents per cubic yard except the section through Boggy levee, which is estimated at 20 cents. It was assumed that the waste banks were of equal volume on each side of the existing Clay Bayou ditch. In calculating the excavation the end areas of the proposed ditch

through this reach were decreased by an amount equal to one-half the area of the present ditch.

ESTIMATE OF COST.

All the dredge work is estimated at 8 cents per cubic yard except a limited amount in ditches Nos. 19 and 43, which is estimated at 9 cents owing to difficulties of deep excavation. Team work is estimated at 20 cents per cubic yard. The purchase cost of all right of way is estimated at $20 per acre, and the cost of clearing it is included in the unit cost of excavation. The estimated cost for cleaning channels is $1,000 per mile, except some light clearing on ditch No. 81 at $500 per mile and heavy work on ditch No. 19 at $2,000 and $3,000 per mile. No estimate of the cost of bridges has been included, for the reason that the State law provides [1] that drainage districts are not required to pay for the construction of either railroad or highway bridges. The accompanying table of cost contains a summary of all the work necessary for the construction of each ditch, besides the estimate of its cost.

Table of cost.

Ditch No.	Length.		Right of way.		Clearing channel.		Excavation.		Total cost.
	Feet.	Miles.	Acres.	Cost.	Miles.	Cost.	Cubic yards.	Cost.	
1	28,535	5.40	65	$1,300			191,500	$15,320	$16,620
2	14,110	2.67	30	600			72,100	5,768	6,368
3	17,795	3.37	41	820			134,600	10,768	11,588
4	11,780	2.23	25	500			55,500	4,440	4,940
5	19,950	3.78	45	900			94,100	7,528	8,428
6	22,450	4.25	50	1,000			109,600	8,768	9,768
7	18,790	3.56	45	900			99,100	7,928	8,828
8	14,570	2.76	35	700			78,000	6,240	6,940
9	11,790	2.23	25	500			59,600	4,768	5,268
10	9,700	1.84	25	500			43,900	3,512	4,012
11	10,800	2.05	25	500			46,700	3,736	4,236
12	6,770	1.28	15	300			35,500	2,840	3,140
13	78,100	14.79	470	9,400			2,082,500	166,600	[2] 181,300
14	9,000	1.71	21	420			42,900	3,432	3,852
15	16,200	3.07	37	740			82,900	6,632	7,372
16	16,200	3.07	37	740			102,400	8,192	8,932
17	17,500	3.32	40	800			81,000	6,480	7,280
18	89,600	16.97	300	6,000			783,300	62,664	68,664
19	401,500	76.04	747	14,940	[3] 49.75	$100,010	[4] 3,461,206	283,621	[5] 406,571
20	22,700	4.30	52	1,040			131,000	10,480	11,520
21	8,300	1.57	19	380			43,100	3,448	3,828
22	16,900	3.20	39	780			92,800	7,424	8,204
23	204,40	4.62	56	1,120			140,100	11,208	12,328
24	8,600	1.63	18	360			35,800	2,864	3,224
25	8,100	1.53	17	340			32,600	2,608	2,948
26	9,500	1.80			1.80	1,800			[6] 1,950
27	5,300	1.00	11	220			22,000	1,760	1,980
28	5,300	1.00	11	220			22,600	1,808	2,028
29	19,500	3.70	45	900			99,700	7,976	8,876
30	11,500	2.18	27	540			60,500	4,840	5,380
31	11,300	2.14	26	520			51,400	4,112	4,632
32	29,100	5.51	67	1,340			147,500	11,800	13,140
33	11,400	2.16	26	520			49,400	3,952	4,472
34	23,900	4.53	55	1,100			131,000	10,480	11,580
35	19,900	3.77	46	920			106,000	8,480	9,400

[1] Acts of Arkansas, 1909, Act 279, sec. 28.

[2] Includes earth dam in Walnut Lake, sec. 11, T. 10 S., R. 4 W., $5,000, and earth dam in Caney Bayou, sec. 33, T. 10 S., R. 4 W., $300.

[3] Comprises 49.24 miles heavy clearing, at $2,000 per mile, and 0.51 mile clearing and grubbing, at $3.000 per mile.

[4] Includes 672,500 cubic yards deep excavation, at 9 cents per cubic yard.

[5] Includes earth dam in Coon Bayou, sec. 18, T. 11 S., R. 3 W., $1,000, and closing openings in banks of Bayou Macon, $7,000.

[6] Includes earth dam in Oak Log Bayou, sec. 30, T. 9 S., R. 2 W., $150.

Table of cost—Continued.

Ditch No.	Length.		Right of way.		Clearing channel.		Excavation.		Total cost.
	Feet.	Miles.	Acres.	Cost.	Miles.	Cost.	Cubic yards.	Cost.	
36	24,900	4.72	57	$1,140			140,300	$11,224	$12,364
37	24,900	4.72	57	1,140			128,400	10,272	11,412
38	20,900	3.96	48	960			105,100	8,408	9,368
39	21,000	3.98	48	960			107,300	8,584	9,544
40	18,500	3.50	42	840			94,700	7,576	8,416
41	14,400	2.73	33	660			76,800	6,144	6,804
42	13,300	2.52	30	600			70,400	5,632	6,232
43	194,800	36.89	1,500	30,000	0.53	$530	[1] 7,272,200	586,485	[2] 623,615
44	22,400	4.24					104,600	8,368	8,368
45	13,200	2.50					69,100	5,528	5,528
46	5,300	1.00	12	240			28,300	2,264	2,504
47	6,600	1.25	15	300			37,900	3,032	3,332
48	5,300	1.00	12	240			38,300	2,264	2,504
49	6,600	1.25	15	300			35,200	2,816	3,116
50	10,600	2.01	23	460			56,600	4,528	4,988
51	15,300	2.90	34	680			82,500	6,600	7,280
52	7,900	1.50	19	380			42,200	3,376	3,756
53	6,600	1.25	15	300			34,700	2,776	3,076
54	12,900	2.44	29	580			66,900	5,352	5,932
55	8,100	1.53	19	380			44,400	3,552	3,932
56	5,800	1.10	13	260			31,600	2,528	2,788
57	8,200	1.55	18	360			42,800	3,424	3,784
58	5,300	1.00	12	240			28,800	2,304	2,544
59	7,200	1.36	16	320			36,900	2,952	3,272
60	4,400	.83					23,900	1,912	1,912
61	14,700	2.78	33	660			72,400	5,792	6,452
62	17,800	3.37	21	420	1.38	1,380	64,200	5,136	6,936
63	4,700	.89	11	220			25,100	2,008	2,228
64	7,800	1.48	18	360			41,700	3,336	3,696
65	8,900	1.68	16	320			38,800	3,104	3,424
66	44,900	8.50	80	1,600			205,600	16,448	18,048
67	54,100	10.25	69	1,380	5.71	5,710	207,200	16,576	23,666
68	19,600	3.71	44	880			94,100	7,528	8,408
69	10,200	1.93	23	460			49,900	3,992	4,452
70	14,500	2.75	30	600			78,900	6,312	6,912
71	3,920	.74	9	180			21,800	1,744	1,924
72	16,006	3.03	35	700			88,600	7,088	7,788
73	18,000	3.41	40	800			97,600	7,808	8,608
74	35,400	6.70	75	1,500			187,900	15,032	16,532
75	45,500	8.62	90	1,800			278,800	22,304	24,104
76	74,500	14.11	84	1,680	6.91	6,910	237,000	18,960	27,550
77	20,900	3.96	48	960			124,300	9,944	10,904
78	17,300	3.28	40	800			113,700	9,096	9,896
79	25,000	4.74	55	1,100			180,100	14,408	15,508
80	25,500	4.83	63	1,260			143,700	11,496	12,756
81	212,270	40.20	735	14,700	[3] 17.67	14,530	[4] 3,137,500	217,376	246,614
Total	2,226,730	421.72	6,279	125,580	83.75	130,870	22,600,700	1,825,874	2,102,374

Cost of construction, as above	$2,102,374
Contingencies, estimates 5 per cent	105,119
Total cost	2,207,493

Number of acres benefited, 294,784.
Average cost per acre, $7.49.

[1] Includes 470,900 cubic yards of deep excavation, at 9 cents per cubic yard.
[2] Includes concrete drop, sec. 31, T. 10 S., R. 2 W., $5,600, and earth dam in Cypress Creek, sec. 31, T. 9 S., R. 2 W., $1,000.
[3] Includes 6.28 miles light clearing, at $500 per mile.
[4] Includes 53,200 cubic yards team work, at 20 cents per cubic yard.

MAINTENANCE.

All drainage channels eventually require attention if they are to maintain their maximum efficiency. The ditches should all be examined at least once every year, preferably just before the rainy season, and all stumps, logs, brush, and other débris which obstruct the channel and retard the flow of water should be removed. No fences, fish traps, or piling should be permitted in the channels. The actual

work necessary to keep the ditches in shape will not be very great if it be attended to each year, but if the ditches are not properly maintained they will deteriorate rapidly and in a few years will require extensive and costly repairs. The officials of the drainage district should provide for regular inspection of all the channels and other construction and arrange to do promptly any maintenance work that may be needed.

A COMPREHENSIVE DRAINAGE SYSTEM NEEDED.

Before Desha County can be developed to any considerable extent, efficient drainage must be obtained. The diversion of Cypress Creek and the closure of the gap in the levee will be the first vital step toward that end, but that will not be sufficient. While it would be possible to do that much by making only one diversion channel along the route considered in the plan of the Mississippi River Commission, the work could not be done economically, it would be of practically no value to the major portion of the district except in such extraordinary floods as those of 1912 and 1913, and it would cost much more than the recommended plan in proportion to the benefits resulting. The construction of ditches Nos. 13, 18, 19, 43, and 81, as described in this report, would not only permit the levee gap to be closed and provide adequate outlet channels for the whole district, but also would permit the immediate improvement of a considerable area along those watercourses. The cost of those five ditches is summarized below:

Cost of ditches.

Ditch No.	Length.	Cost.
	Miles.	
13	14.79	$181,300
18	16.97	68,664
19	76.04	406,571
43	36.89	623,615
81	40.20	246,614
	184.89	1,526.764
Contingent expenses, 5 per cent		76,338
Total		1,603,102

While the submains and laterals can be constructed at any time after the main ditches, the cost will be less if the whole project is carried out at once than if a part is deferred. The construction of these smaller ditches will add only 38 per cent to the cost of the five main ditches just enumerated, and in view of the low total cost, estimated at $7.49 per acre, it is recommended that the construction be continued from the beginning to the completion of the entire system for which the plans have been made.

○

R. 5 W. R. 4 W. R. 3 W. R. 2 W. R. 1 W.

T. 8 S. T. 9 S. T. 10 S. T. 11 S. T. 12 S. T. 13 S. T. 14 S.

Cades Gould Lear Reedville Dumas Walnut Lake Winchester Tillar McGehee Trippe Junction Baxter Dermott Hurds Halley Kelso Rohwer McArthur Watson Red Fork Yoncapin Arkansas City

COUNTY LINE — LINCOLN DESHA — DESHA CHICOT — DESHA DREW — DREW CHICOT

LEVEE

ARKANSAS RIVER — MISSISSIPPI RIVER

Silver L. — Davis Lake — Belcoe L. — Lennox L. — Yoncapin L. — Jefferson L. — Cheatham Dead L. — Bachelor L.

Cypress Creek — Oak Wood Bayou — Eugene Bayou — Choctaw Bayou — Wells Bayou — Ladd Lumber Canal — Walnut Lake — Cook's Brake — Wilburn L. — Pickens Ditch — Eastham Brake — Caney-Bayou Brake — Coon-Bayou Brake — Dry Bayou — Oak Log Bayou — Dorian Bayou — Dixon Bayou — Willow Slough — Kinsloe Slough — Possumhaw Slough — Carter Slough — Mound L. — Red Fork Bayou — Cross Bayou — Sutton Bayou — Johnson Brake — Amos Bayou — Cheatham Dead L. — Cypress Brake — Possum Fork — Pipaw Brake — Austin Brake — Little Bayou — Macon Bayou — Boggy Bayou — Bartholomew Bayou — Crooked Creek — Black Pond Slough — Big Bayou — Hurds Slough — Pond Slough — Chicot Ditch — Fulton Bayou — Johns Bayou — Cypress Brake — Kelley Ditch — Dry Bayou — Boggy Bayou — Bachelor L. — Tad Wash — Last Chance Bayou — Tour Mine Ditch — Boggy Cut-off — Tram Rd.

St. L. I. M. & S. R. R.

141.65 4-16-12 — 142.8 4-17-12 — 143.3 4-17-12 — 144.7 4-18-12 — 148.6 4-17-12 — 148.8 4-17-12 — 155.6 4-16-12 — 156.3 4-17-12 — 156.5 4-17-12 — 156.5 4-18-12 — 156.4 4-16-12 — 141.9 4-19-12 — 140.65 4-16-12

LEGEND

Flooded Area shown thus.....

Elevation and Date of Flood Water..... 141.65 4-16-12

Elevations are referred to Desha County Survey Datum which is 7.35 ft. below Memphis Datum.
Approximate area flooded = 202,300 Acres.

LOWER BOUNDARY OF DISTRICT

Fig. 2

U.S. DEPT. OF AGRICULTURE BUL. 198 — OFFICE OF EXPERIMENT STATIONS

DRAINAGE INVESTIGATIONS

AREA OVERFLOWED IN 1912

CYPRESS CREEK DRAINAGE DISTRICT

DESHA AND CHICOT COS., ARK.

Overflow due to opening in levee at mouth of Cypress Creek

Prepared to accompany a report on the Drainage of the Cypress Creek District

SCALE OF MILES

1 ½ 0 1 2 3 4 5

G F POHLERS, del

R. 5 W. R. 4 W. R. 3 W. R. 2 W. R. 1 W.

T. 8 S. T. 9 S. T. 10 S. T. 11 S. T. 12 S. T. 13 S. T. 14 S.

Cades Gould Lear Reedville Dumas Walnut Lake Winchester Tillar Medford Red Fork Watson Yoncapin Kelso Rohwer McArthur McGehee Trippe Junction Arkansas City Halley Hurds Dermott Baxter Amos

ARKANSAS RIVER

MISSISSIPPI RIVER

LINCOLN COUNTY DESHA LINE

DESHA COUNTY DREW LINE

DESHA COUNTY CHICOT LINE

DREW COUNTY CHICOT LINE

BLACK POND DRAINAGE DISTRICT

BARTHOLOMEW

BAYOU

Cypress Creek Wood Bayou Choctaw Bayou Walnut Bayou Dorcheat Bayou Wells Bayou Amos Bayou Coon Bayou Little Bayou Macon Bayou Big Black Bayou Black Pond Slough Cypress Brake Bayou Boggy Bayou Red Fork Bayou Belcoe L. Yoncapin L. Dead Lakes Ozark Lake Bachelor Lake

5th Prin. Meridian S. of Arkansas R.

To Warren

LEGEND

Proposed Ditches
Proposed Channel Clearing
District Boundaries
Watershed Boundaries
Levee
County Lines
Township Lines
Section Lines
Railroads
Roads
Streams Not Meandered
Surface Elevations
Bottom Elevations of Streams
Elevations of Top of Levee
Elevations of Top of Rail
Bench Marks
Width of Channels — Top — Bottom
Ditch Numbers

NOTES – To reduce elevations to Memphis datum add 7.35 feet.

Information on South Lines of Sections 13 to 30 inclusive, T. 14 S., R. 2 W. obtained from Chico County Drainage District.

Fig. 3

U.S. DEPT. OF AGRICULTURE BUL. 198 — OFFICE OF EXPERIMENT STATIONS

DRAINAGE INVESTIGATIONS

MAP OF CYPRESS CREEK DRAINAGE DISTRICT

DESHA AND CHICOT COUNTIES, ARKANSAS

Prepared to accompany a Report on the Drainage of the Cypress Creek Drainage District

by

O. G. Baxter, D. L. Yarnell, and L. A. Jones, Drainage Engineers

1912

Scale of Miles

R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 6 S. T. 7 S. T. 8 S. T. 9 S. T. 10 S.

Noble Lake
Noble Lake
ST. LOUIS
Linwood
Moscow
COUSART
DRAINAGE
DISTRICT
IRON MOUNTAIN
Jacks Bayou
Taymo
SOUTHERN
Cousart Deep Bayou
JEFFERSON
LINCOLN
COUNTY
LINE
Shannon Tank
Grady
LEVEE
ARKANSAS
RIVER
Cut-off 1904
Long Lake
Ditch
GRASSY LAKE
Middle Cane
Wild Cat Lake
Goose Pond
H.W. 171.6 Ditch
Varner
Cypress Creek
Oak Wood Bayou
Lake Dian
LEVEE
COUNTY
LINE
LINCOLN
DESHA
Cades
Choctaw Bayou
Cash L.
Gould
Oak Log
Deep Bayou
Lake Bayou
Furth
Maronia
Champion
Cross Bayou
Bartholomew Bayou
Wagon Bayou
Wells Bayou
COUNTY
LINE
LINCOLN
DESHA
LINCOLN
DREW
COUNTY
LINE

Fig. 4

U.S. DEPT. OF AGRICULTURE BUL. 198 —— OFFICE OF EXPERIMENT STATIONS

DRAINAGE INVESTIGATIONS

WATERSHED OF CYPRESS CREEK

LINCOLN AND JEFFERSON COUNTIES

ARKANSAS

Prepared to accompany a report on the Drainage of Cypress Creek District

1912

SCALE OF MILES

1 ¾ ½ ¼ 0 1 2 3 4 5 6

LEGEND

Watershed Boundary

Arkansas River Levee

Elevations of Ground Surface (B.M.A.13 (664.2), B.M.S.234 (663.7), 171.8, (170.9), 175.2)

Elevations of Bottoms

Bench Marks ⌶ B.M.A.13 ⌶ B.M.S.234 ⌶ B.M.P.79

G.F. POHLERS, del.

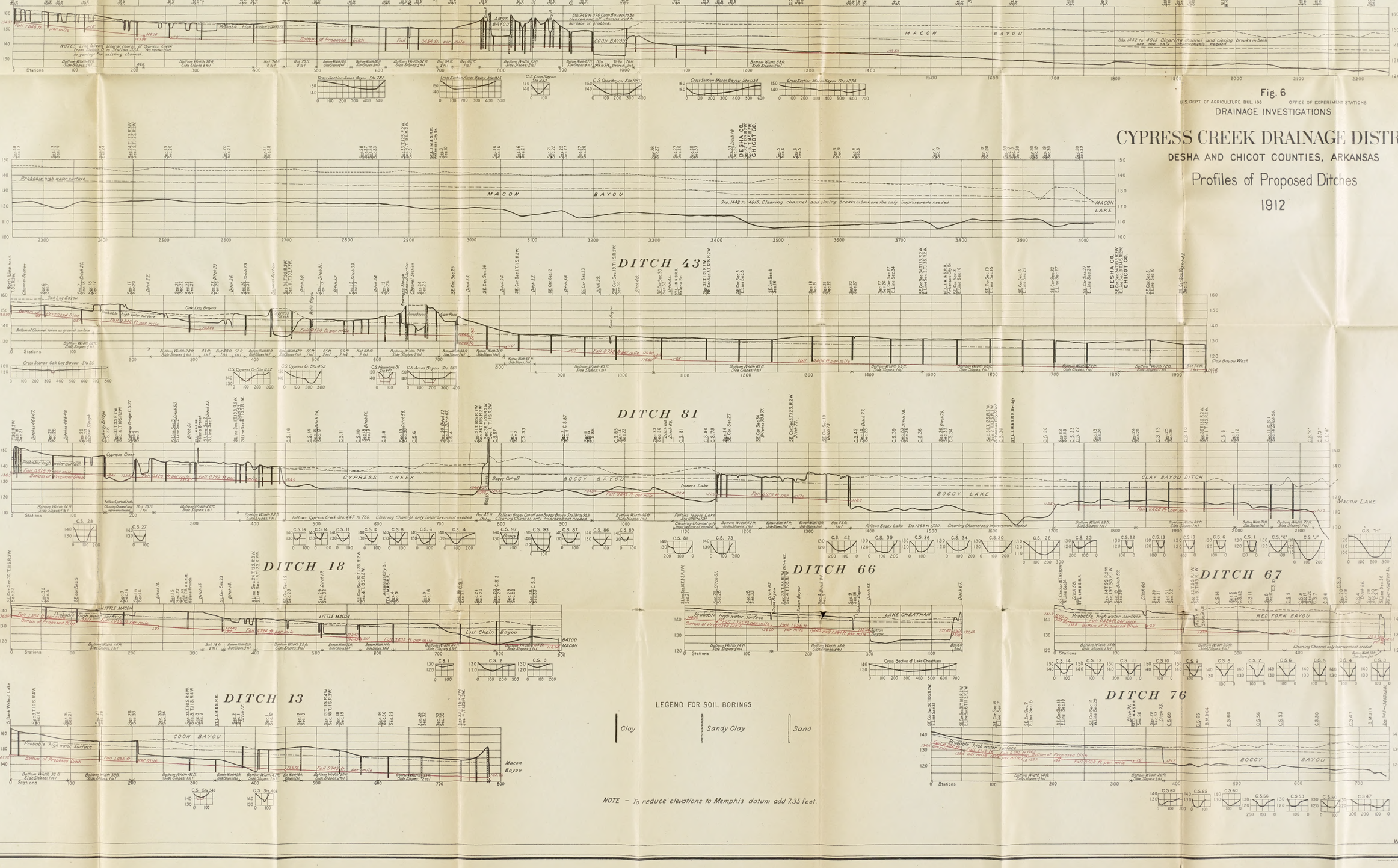

Fig. 6

U.S. DEPT. OF AGRICULTURE, BUL. 198 OFFICE OF EXPERIMENT STATIONS

DRAINAGE INVESTIGATIONS

CYPRESS CREEK DRAINAGE DISTRICT

DESHA AND CHICOT COUNTIES, ARKANSAS

Profiles of Proposed Ditches

1912

W.D.N.